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ABSTRACT

This study evaluates a new method of administering a trunk-curl test of abdominal muscular endurance and establishes a series of norms for college students and adults. The test utilizes a piece of cardboard that is cut out so that it can be held at the level of the navel of the testee and perpendicular to the floor. The test is administered with fingers interlaced behind the head, knees bent, and feet not anchored. The elbow must touch the board on the opposite side for each score. Ninety-six college students were given four test trials to determine test-retest reliability for both timed and untimed test administrations. Reliability coefficients of .91 and .91 were found for timed and untimed administrations, respectively, for female subjects. Coefficients of .80 and .84 were found for the timed and untimed test administrations, respectively, for male subjects. (Tables indicating norms for adults aged 18-56 are presented.) (Author/JS)

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A New Curl-Up Test of Abdominal Endurance

by Larry Noble

(1) For many years physical educators have used some form of sit-ups as a test of abdominal muscular endurance. The most often-used form is with the feet anchored, knees bent, fingers interlocked behind the head, and touching the elbow to the opposite knee. The criteria for selecting this particular test form (conventional sit-up) are unclear. It would appear that the most important criteria for test selection are: (1) ease of administration, (2) validity, (3) reliability, and (4) objectivity. The conventional sit-up has been shown to be easy to administer and to be both objective and reliable; however, evidence provided by electromyographic investigations in recent years cause the validity of this test item to be questioned. These studies indicate that, for maximum involvement of the abdominal muscles (upper and lower rectus abdominis, external obliques, and internal obliques) the sit-up should be done with knees bent, and with the feet not anchored (5). Also, it is not necessary to do a complete sit-up, but merely to lift the shoulders clear of the floor, in order to elicit involvement of the abdominal musculature (4,5,8). One recent electromyographic investigation found the truncated form of sit-ups (trunk-curl) to elicit action potentials of lesser magnitude than did other abdominal exercises; however, in this study, hands were placed at the sides, thereby minimizing the resistance provided by the upper extremity (6). Logically, a test of the ability to repeat this trunk-curl movement would provide a more accurate assessment of abdominal muscular endurance, if the test item could be administered easily without the use of costly equipment and

with acceptable reliability and objectivity.

Purpose

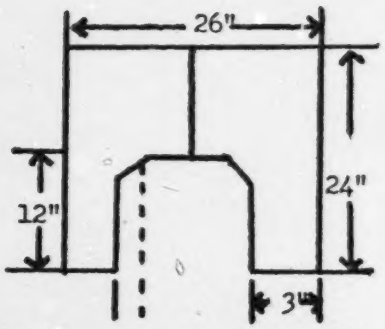
(2) The purpose of this study was to evaluate a new method of administering a trunk-curl test of abdominal muscular endurance. A secondary purpose was to establish norms for college students and adults.

Procedures

(3) Ninety-six college students (48 males and 48 females) at Kansas State University were given four administrations of the trunk-curl test according to the instructions below. Two of the test administrations were given with a 60-second time limit and two administrations were given with no time limit. Twenty-seven graduate students enrolled in the Research Methods class were the test administrators. Subjects were used according to their availability and willingness to participate in the testing series. All tests were given within a 2-week period with no less than 48 hours separating each test administration. Subjects were tested on weekdays only at approximately the same time each day. Test administrators were told not to test subjects who had eaten within 1 hour of the scheduled testing time or who had participated in vigorous exercise on the day of the scheduled test. The order of administering timed and untimed versions was rotated.

Test Instructions

(4) The following equipment is needed: mat or floor and a piece of cardboard or ¼" plywood cut according to the diagram.



(5) The subject lies on his back with his knees flexed to approximately 90° and with the feet flat on the floor and one to two feet apart. The hands are placed behind the head with the fingers interlaced. Do not anchor the feet. The tester places the cardboard over the subject's abdomen at the level of the navel and holds it perpendicular to the floor throughout the test. The subject flexes his spine, beginning at the cervical (neck) area, then the thoracic (chest) area and ending at the lumbar (lower back) area. Near the end of the trunk flexion movement the subject twists the trunk vigorously and touches the right side of the cardboard with the left elbow. He then returns to the starting position, making sure that his hands touch on the floor before curling up again. Subsequent curl-ups are executed in the same manner, alternating left elbow to right side and right elbow to left side. The trunk-curls must be done continuously with no rest pauses. The score is the number of times the elbow touches the cardboard correctly. No score is given if the subject fails to touch the cardboard properly or fails to touch the floor with his hands on the return movement. If the subject fails to do this, tell him immediately and stop the test if he cannot execute the succeeding movement properly.

Results and Discussion

(6) The results of the reliability estimates of timed and untimed test administrations for college males and females are given in Table 1. These coefficients compare favorably with reliability estimates of the sit-up test. Craven (2) reported coefficients of .86, .77, and .88 for bent leg-timed, straight leg-timed, and straight leg-untimed administrations of the sit-up test. College males were used as subjects. Fleishman (3) tested over 200 adult males in performance of the conventional sit-up test (knees straight-feet anchored) and reported r= .72. Buxton (1) reported a coefficient of .94 when administering the bent knee sit-up test to male and female children aged 6-15. Scott (9) reported a reliability coefficient of .94 when testing 140 college women on successive days in performance of the bent-knee sit-up.

(7) Please note the standard errors of estimate. An interpretation of this statistic is that, given a test score x, that same subject would score within the range $x \pm 2\ S_{2 \cdot 1}$ 95 percent of the time on subsequent test administrations.

(8) This test appears to have acceptable consistency for college males and females in both timed and untimed administrations. When deciding on whether timed and untimed versions are best, factors other than reliability such as validity and time in administering the test must therefore be considered. Correlation coefficients between timed and untimed test administrations ranged from .44 to .54 (significant at .05 level) for females and from .16 to .19 (not significant at .05 level) for males. These low coefficients for the males indicate that the timed test measures something quite different from that measured by the untimed test. It is likely that the speed of movement component increases

and the endurance component decreases as the time limit for the test decreases. This causes one to question the validity of the 60-second timed test for those with relatively high abdominal muscular endurance. Also, a 60-second timed test will not allow good discrimination among subjects with high abdominal endurance, but it cuts down the administration time considerably and will give good discrimination for those with low and moderate abdominal endurance.

(9) Normative data for adults aged 18-60 and for eighth-grade girls are presented in Table II. The eighth-grade girls were aged 13 and 14 years. The difference in scores for the two age groups was small and insignificant and it was, therefore, deemed not appropriate to list the scores separately. The sample size for some of the age groups is so small, little confidence can be placed in the scores; however, when considering the considerable differences in scores among the groups, a more accurate portrayal of the data is insured by keeping the groups separate.

Table 1

Test - Retest Data

Sex	Timed r	Timed Mean	Timed S.D.	Timed $S_{2 \cdot 1}$*	Untimed r	Untimed Mean	Untimed S.D.	Untimed $S_{2 \cdot 1}$*
Males	.80	61.67	15.02	9.01	.84	114.17	77.74	41.87
Females	.91	43.02	15.31	6.35	.91	57.88	39.88	16.55

*Standard error of Test 2 as estimated from Test 1.

Table 2

Means & Standard Deviations
for
Curl-Up Tests

Group	Sex	N	Mean	SD	Max.	Min.
Eighth grade	F	192	27.97	13.64	90	2
College students*	F	323	37.39	12.00	66	4
College students*	M	398	49.85	13.55	86	12
Age 18-25	F	14	23.29	13.20	56	5
Age 18-25	M	2	23.00	1.41	24	22
Age 26-35	F	30	26.00	18.52	99	0
Age 26-35	M	14	35.14	12.64	55	17
Age 36-45	F	16	18.25	11.31	47	0
Age 36-45	M	10	30.00	22.53	82	4
Age 46-55	F	11	8.55	8.49	25	0
Age 46-55	M	5	32.00	13.00	51	21
Age 56+	F	3	6.33	7.77	15	0
Age 56+	M	3	3.33	5.77	10	0

*60-second time limit

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